

EFFECTIVENESS OF PASSIVE ROM ON MUSCLE STRENGTH OF PATIENTS WITH HEMIPLEGIA AT GINOWAN MEMORIAL HOSPITAL, JAPAN

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ABSTRACT

Hemiplegia is a condition of paralysis on one side of the body, generally caused by stroke, and significantly impacts motor skills and quality of life. One rehabilitation intervention used to improve muscle strength and mobility in hemiplegic patients is passive Range of Motion (ROM) exercises. This study aims to identify the effectiveness of passive ROM on muscle strength in hemiplegic patients at Ginowan Memorial Hospital, Japan. The method used is a descriptive case study of two hemiplegic patients selected by accidental sampling. The passive ROM intervention was carried out for three days, twice daily for 15-20 minutes. Muscle strength evaluation was carried out using a standardized Manual Muscle Testing (MMT) scale that has been proven valid and reliable in measuring muscle strength, both before and after the intervention. The results of the study showed an increase in MMT scores from 0 to 2 in the upper and lower extremities with paralysis, indicating that the intervention in the form of passive Range of Motion (ROM) exercises was effective in increasing muscle strength in hemiplegia patients. These findings contribute to rehabilitation nursing practice and can be used as a basis for the routine implementation of passive ROM interventions in hemiplegia care.

Keywords: hemiplegia, stroke, passive range of motion (ROM); muscle strength; manual muscle testing (MMT)

INTRODUCTION

Stroke is a very serious neurological emergency and the leading cause of disability and death worldwide (Utomo, 2024). Stroke is a sudden disruption of nervous system function caused by impaired blood circulation to the brain. This circulatory disturbance can occur in the form of a blockage in a blood vessel or a ruptured blood vessel in the brain (Pinzone, 2016). The World Stroke Organization (WSO) states that stroke is the second leading cause of death and the third leading cause of disability worldwide. In 2019, global data showed that there were 101 million cases of stroke worldwide, with 6.55 million of them ending in death (Arsyi, 2024). Based on the incidence rate in developing countries such as Asia, non-hemorrhagic stroke, commonly called ischemic stroke, reached 30%, while according to the stroke registry in Japan, the figure shows 43.4/1,000,000 people per year in stroke incidents (Gandi, 2024).

Stroke is characterized by paralysis of several organs in the body, known as hemiplegia (Varma et al., 2023). Hemiplegia is paralysis on one side of the body or acute motor neurological dysfunction caused by a stroke (Kothandapani et al., 2025). Hemiplegia is divided into two types: right hemiplegia (right) and left hemiplegia (left). Right hemiplegia is caused by damage to the left cerebral cortex. Symptoms generally include aphasia (difficulty reading, communicating, and writing). Left hemiplegia, on the other hand, is caused by damage or blockage to the right cerebral cortex. Sufferers generally tend to experience difficulties with visual-spatial perception and visual-motor skills (drawing or dressing) (Tri et al., 2025). According to Varma et al (2023) and Li et al (2025) common etiologies of hemiplegia include: stroke (Ischemic and Hemorrhagic), Traumatic brain injury (TBI), brain tumor, brain infection (Meningitis or Encephalitis), autoimmune disorders (Multiple Sclerosis).

Hemiplegia occurs when there is damage to the motor pathways on one side of the brain or spinal cord due to central nervous system damage. Some nerves from the nerve pathways cross to the opposite side in the medulla oblongata. This crossing causes damage to one hemisphere of the brain and paralysis on

one side of the body. This damage can generally be caused by stroke, brain trauma, brain tumor, infection, or demyelinating diseases such as multiple sclerosis. When this disruption occurs, motor neurons cannot send signals to the brain, resulting in weakness or paralysis (Kuriakose & Xiao, 2020).

According to Joyce et al (2023) stated that clinical manifestations that often appear in hemiplegia include weakness or tingling sensations in the extremities, loss of vision due to optic neuritis, loss of coordination due to cerebellar involvement, bowel and bladder dysfunction due to spinal involvement. Meanwhile, according to Diana et al (2023) said that, clinical manifestations in hemiplegia, such as difficulty speaking, difficulty walking and coordinating body parts, headaches, facial muscle weakness, visual disturbances, sensory disturbances, disturbances in the thought process, loss of motor control. According to Syamsuddin & Adam (2023), supporting examinations include CTA/CT Angiography, CT-Scan of the brain, MRI of the brain, Electro Encephalogram (EEG), Ultrasonography Doppler (USG Doppler), chest photo examination, laboratory examination, X-ray of the skull. Management of hemiplegia includes medical therapy and non-pharmacological therapy. Medical therapy includes Baclofen or tizanidine (relaxes muscles), Anticoagulants, Antiplatelets (aspirin), and statins (prevents recurrent strokes), Antihypertension (controls blood pressure), and Brain infections (Antibiotics or antivirals). Meanwhile, non-pharmacological therapy includes ROM (passive or active).

Range of Motion (ROM) exercises are a fundamental intervention for the effectiveness of therapy in preventing permanent disability in post-stroke (hemiplegic) patients, performed in hospitals (Ardilla et al., 2024). According to Andriyani (2022), Range of Motion (ROM) is a form of exercise that involves moving joints in a normal and complete manner to maintain or improve muscle strength and tone. The exercises focus on the patient's ability to recognize and control movement effectively, rather than on the extent of the movement, and are tailored to the individual's needs and capacities. According to Ardilla et al. (2024), ROM therapy is divided into two types, namely active ROM and passive ROM. Active ROM is energy or movement that is released within oneself. Active ROM exercises are carried out by patients who are able to perform ROM independently and have 75% muscle strength. Passive ROM involves the energy expended by another person, caregiver, or assistive device for each movement. Passive ROM is usually performed on patients with decreased consciousness, unable to carry out independent exercises, complete bed rest, complete paralysis of the limbs, and 50% muscle strength. ROM is performed on extremity joints such as shoulders, elbows, wrists, fingers, groin, knees, ankles and toes, or on paralyzed extremities (Puspitasari et al., 2024). The aim of this exercise is to maintain and maintain muscle strength, maintain joint mobility, improve blood circulation, prevent deformities, and restore motor control (Puspitasari et al., 2024).

The basic principles of ROM exercises include that it is recommended to be done twice a day, namely in the morning and evening, carried out for 15-20 minutes each, 8 repetitions, carried out the exercises regularly for one to two weeks, ROM is carried out carefully and does not tire the patient, ROM is programmed by a physiotherapist and carried out by a physiotherapy nurse, ROM is recommended to be carried out after bathing or routine treatment has been completed (Andriyani et al, 2022). According to Agusriyanto (2020), passive ROM training movements include flexion and extension movements in the shoulder joint, flexion and extension movements in the elbow, supination and pronation movements in the forearm, flexion and extension movements in the forearm, circumduction movements in the thumb, flexion and extension of the fingers, flexion and extension movements in the groin, flexion and extension movements in the knee, circumduction movements in the ankle. There is general evidence that passive ROM exercises can improve quality of life, but the effectiveness of passive ROM exercises specifically in this hospital setting has not been evaluated in depth. Therefore, this scientific work focuses on

identifying the effectiveness of passive ROM on muscle strength in patients experiencing hemiplegia in the hospital, in order to provide stronger basic knowledge and evidence for rehabilitation interventions in this context.

METHOD

In this study the author used a descriptive method, a case study approach, focusing on patients who experienced hemiplegia. The subjects in this study were 2 individuals diagnosed with hemiplegia. Subject selection was carried out by accidental sampling. The instrument used was a Manual Muscle Testing (MMT) scale observation sheet with a scale of 0-5. This research was conducted on the 7th floor of Ginowan Memorial Hospital, Japan. Each nursing care action is carried out for 3 days starting from 2 November 2024 – 6 November 2024. The intervention is carried out every day in the morning and afternoon with a time of 15 -20 minutes each. Muscle strength measurements were carried out using the Manual Muscle Testing (MMT) scale on paralyzed extremity muscles in hemiplegic patients. Muscles assessed include:

1. Shoulder muscles (flexion and extension)
2. Elbow muscles (flexion and extension)
3. Forearm muscles (supination and pronation)
4. Wrist muscles (flexion and extension)
5. Finger muscles (circumduction)
6. Pelvic muscles (flexion and extension)
7. Knee muscles (flexion and extension)
8. Leg muscles (circumduction)

Each movement is done 8 times with short rest breaks between joints. During exercise, the nurse will monitor vital signs (blood pressure, body temperature and oxygen saturation). The analysis was carried out in a comparative descriptive manner by comparing the MMT score results before and after passive ROM intervention. An increase in the MMT score will indicate an increase in muscle strength

RESULT AND DISCUSSION

Based on the case studies that have been carried out, the assessment of patient 1 with the initials Mrs. N, aged 75 years, female, experienced right hemiplegia. Mrs. N complained of difficulty moving her right extremities accompanied by a feeling of stiffness. The patient has a history of stroke and hypertension in the family history. Objective data shows BP: 139/90 mmHg, N: 88 times/minute, S: 36.2 oC, RR: 18 times/minute, SpO2 96%, CT-Scan results show a focal hyperdense area in the left basal ganglia, the right extremity looks immobile and stiff, there is spasticity in the fingers of the right hand, muscle strength is based on the MMT score scale,

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Assessment of patient 2 with the initials Mr. E, 80 years old, male, has left hemiplegia. Mr. E complained of not being able to move the left side of his body, muscle weakness accompanied by a feeling of numbness or numbness. The patient said this was the first time he had experienced this disease and there was no family history of the disease. Obtained objective data, namely BP: 137/85 mmHg, N: 80 times/minute, S: 36.4 oC, RR: 16 times/minute, SpO2: 97%, CTScan results found a focal hyperdense area in the right basal ganglia, spasticity in the left hand, muscle strength based on the MMT score scale,

0		5
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The main diagnosis of Physical Mobility Disorders in patients is determined based on the results of the history which shows limitations in moving the extremities, decreased muscle strength, joint stiffness, and numbness. Impaired physical mobility is defined as limitations in the physical movement of one or more extremities independently (SDKI DPP PPNI Working Group Team, 2017). In this case study, researchers applied nursing interventions to two patients diagnosed with physical mobility disorders, namely passive Range of Motion (ROM) exercises. This exercise will focus on the extremity experiencing hemiplegia. The intervention plan will be carried out for 3 days by nurses and other medical personnel. Exercises are carried out in the morning and evening for 15-20 minutes. To assess the effectiveness of passive ROM exercises, this case study focuses on measuring muscle strength by Manual Muscle Testing (MMT) before and after exercise, with the aim of monitoring changes in muscle strength and as a basis for evaluating the success of the intervention. One study also stated that passive Range of Motion (ROM) training is an appropriate and effective intervention for patients with impaired physical mobility in hemiplegic patients, because this exercise can increase the ability to move joints optimally, and help strengthen muscle mass and tone, thus supporting the recovery of function and preventing further disability (Fitrah Akadji et al., 2025).

This case study was carried out over 3 days, for patient 1 it was carried out on 2 November 2024 – 4 November 2024 and for patient 2 on 4 November 2024 – 6 November 2024 on the 7th floor of Ginowan Memorial Hospital, Japan. Before starting, researchers provided informed consent and ensured that each patient was in a stable condition. The intervention was carried out twice a day, in the morning for patient 1 at 09.00 and patient 2 at 10.00, in the afternoon for patient 1 at 15.00 and patient 2 at 16.00, with the duration of each session being around 20 minutes. At each training session, researchers always observe the patient's condition such as observing the patient's TTV, patient's muscle strength, then continue with passive ROM exercises.

Table 1.
 Comparison table of Manual Muscle Testing (MMT) post-test and pre-test scores in patient

Date	Muscle strength			
	Pre test		Post test	
	Left	Right	Left	Right
02 Nov 2024	4	0	4	0
Atas	-----		-----	
Bawah	3	0	3	0
03 Nov 2024	4	0	4	1
Atas	-----		-----	
Bawah	3	1	3	1
04 Nov 2024	4	2	4	2
Atas	-----		-----	
Bawah	3	2	3	2

Table 2.
 Comparison table of Manual Muscle Testing (MMT) post-test and pre-test scores in patient 2

Date	Muscle strength			
	Pre test		Post test	
	Left	Right	Left	Right
04 Nov 2024	0	5	0	5
Atas Bawah	0	5	0	5
05 Nov 2024	1	5	1	5
Atas Bawah	1	5	1	5
06 Nov 2024	2	5	2	5
Atas Bawah	2	5	2	5

In measuring the effectiveness of the intervention, the patient's muscle strength was measured using the MMT scale at the beginning of the first day (Pre-Test) and at the end of the third day (Post-Test). During the implementation of passive ROM, an increase in the patient's muscle strength was seen on certain days. Patient 1 showed progress on the second and third days, where flexion and extension movements at the elbow and wrist began to be performed, followed by the ability to circumduct the thumb and flex the fingers independently. Meanwhile, patient 2 experienced significant improvement on the third day, with flexion and extension movements in the knees and ankles starting to become active, along with the ability to maintain a more stable sitting position thanks to strengthening the groin muscles. These improvements reflect the effectiveness of passive ROM interventions in gradually stimulating muscle strength and mobility.

Nursing evaluation was carried out to assess the effectiveness of passive ROM exercise intervention in increasing extremity muscle strength in patients. After three days of intervention, the problem of physical mobility barriers was partially resolved with the resulting criteria increasing muscle strength in the extremities. Increased muscle strength is proven by Manual Muscle Testing (MMT) scores from 0 to 2 in the extremities.

Table 1.
 Comparative table of muscle strength MMT scores pre-test and post-test

Patient	Muscles assessed	Pre-Test	Post-Test	Change
Patient 1	Upper extremities	0	2	+2
Hemiplegia dextra	Lower extremities	0	2	+2
Pasien 2	Upper extremities	0	2	+2
Hemiplegia sinistra	Lower extremities	0	2	+2

In patient 1, before the intervention was carried out, the muscle strength of the right upper and lower extremities showed a score of 0, meaning there was no muscle contraction. After doing passive ROM exercises for 3 days in the morning and evening, there was an increase in muscle strength to a score of 2. The patient showed pulling movements at the elbows and knees when in bed with the body lying on the side, this shows the ability to move without fighting gravity or moving laterally and on a mat. This indicates a positive response regarding passive ROM exercises.

In patient 2, the initial condition showed a score of 0 in both the upper and lower left extremities. After the passive ROM training intervention was given, there was an increase in muscle strength to 2 patients showing movement of the left leg when lying in bed and movement of the left hand when eating or when the hand was on the table, indicating that the muscles could move without fighting gravity. This increase shows that passive ROM training, apart from maintaining muscle function, can also stimulate gradual recovery of muscle strength.

The increase in Manual Muscle Testing (MMT) scores after passive Range of Motion (ROM) training in hemiplegic patients can be explained by physiological mechanisms. According to the *Neuromuscular Physiotherapy Textbook* by Hendrawan (2025), passive exercise is able to provide a mechanical stimulus to muscle fibers which plays a role in maintaining muscle tone and preventing atrophy due to prolonged immobilization. Motor unit recruitment occurs where passive muscle stretching can activate receptors such as muscle spindles and Golgi tendon organs, which then send signals to the central nervous system to maintain neuromuscular connections, even though the patient does not make voluntary movements. Passive ROM exercises prevent atrophy by providing repeated stimulation, so that muscle strength is maintained even though the patient cannot move.

The theory by Purwantiningrum (2023), suggests that this process is also related to the theory of neuroplasticity, namely the ability of muscles to form new nerve pathways to replace lost function. Repetitive sensory input from passive ROM exercises strengthens cortical reorganization so that patients begin to show muscle contractions to simple movements and then show an increase in MMT scores. Passive ROM exercises also improve microcirculation by increasing local blood flow in the muscle area, improving oxygen distribution, and accelerating the removal of metabolic substances, so that the muscles are in better condition to recover and function normally.

The results of this evaluation strengthen the theory put forward by Puspitasari (2024) and Ardilla et al. (2024), stated that the intervention was carried out according to the basic principles of passive ROM training, which was carried out twice a day, namely in the morning and evening, with a training duration of 15-20 minutes, with 8 repetitions of the movement. This can provide benefits such as maintaining muscle strength, increasing joint flexibility, improving blood circulation, and preventing contractures. Overall, passive ROM exercise interventions have been shown to be effective in improving mobility in hemiplegic patients. This evaluation provides a theoretical basis for nurses to implement passive ROM exercises as a routine intervention in nursing practice, particularly in patients with impaired physical mobility due to stroke.

CONCLUSION

Passive Range of Motion (ROM) exercises carried out for 3 days, namely 2 times a day in the morning and evening, for 15-20 minutes, have been proven to be effective in increasing muscle strength in hemiplegic patients at Ginowan Memorial Hospital, Japan. This effectiveness is proven by an increase in Manual Muscle Testing (MMT) scores, namely in patient 1 (Hemiplegia dextra) and patient 2 (Hemiplegia sinistra) the MMT score showed an increase from 0 (No muscle contractions) to 2 (Able to move extremities without resisting gravity). Apart from increasing muscle strength, passive Range of Motion (ROM) training also has the benefit of maintaining muscle function, improving blood circulation, increasing joint flexibility, preventing contractures and helping gradual recovery. Thus, this nursing intervention was successful in overcoming some of the problems of impaired physical mobility in hemiplegic patients according to the stated goals.

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